Advanced Image Processing - Morphology II.

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13.11.2018

Granulometry

Opening with various SE

If we open a binary image with consecutively bigger structural elements we can retrieve information about the distribution of the object sizes.

Exercise

Open the image granulometria.png with consecutively bigger structural elements. Display a bar graph showing the relationship between the area of the opened image and the size of the SE.

Conditional dilation

Conditional dilation - definition

The image is thresholded with two different thresholds. We thus obtain two images: A for the higher threshold and B for the lower one. Conditional dilation with structural element SE is defined as: $(A \oplus SE) \cap B$.

Exercise

Test the conditional dilation for the image bunky.png.

Grayscale erosion and dilation

Dilation and erosion

Having an image f and a structural element b, then
$f \oplus h = max\{f(x,y) + b(r-x, s-y) | (r,s) \in E\}$ and
$f \ominus h = min\{f(x,y) - b(r-x, s-y) | (r,s) \in E\}$

Matlab

Function names in Matlab are the same as function names for binary images.

Úloha

Test dilation, erosion, opening and closing on the image zatisie.pgm. Use closing and subsequent opening to smooth the image.

Morphological gradient

Morphological gradient

$$grad(I) = \frac{(I \oplus SE) - (I \ominus SE)}{2}$$

Morphological gradient - internal

$$grad(I) = I - (I \ominus SE)$$

Morphological gradient - external

$$grad(I) = (I \oplus SE) - I$$

Úloha

Otestujte detekciu hrán pomocou morfologického gradientu.

Top-hat and bottom-hat transformation

Top-hat transformation

Top-hat transformation is the difference of the original image and its opening. Bottom-hat transformation is the difference of the closing of an image and its original.

imtophat

imtophat(I, SE) - returns top-hat transformation of the image with structural element SE

imbothat

imbothat(I, SE) - returns top-hat transformation of the image with structural element SE

Adaptive segmentation

Segmenting on non-constant background

We can utilize the top-hat transformation to segment light objects on non-constant background. Bottom-hat can be used to segment dark objects.

Exercise

Segment the qr codes in qr.png and rice from rice.png (included in Matlab)

Contrast correction

Increasing contrast

We can increase the image contrast by adding the top-hat transformation and subtracting the bottom-hat transformation from the original.

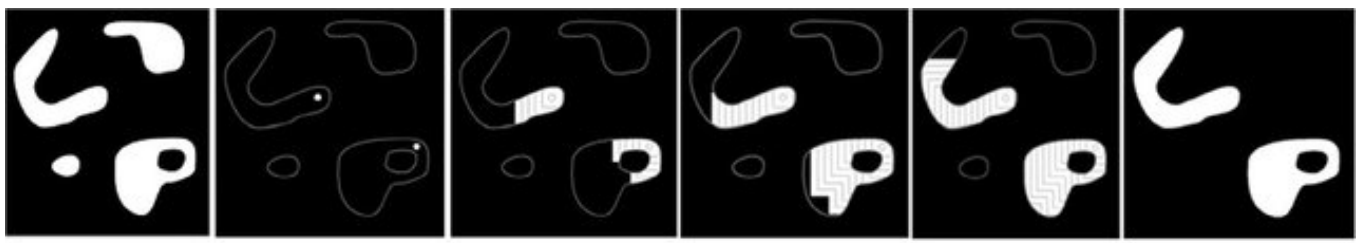
Exercise

Increase contrast in krajinka.png

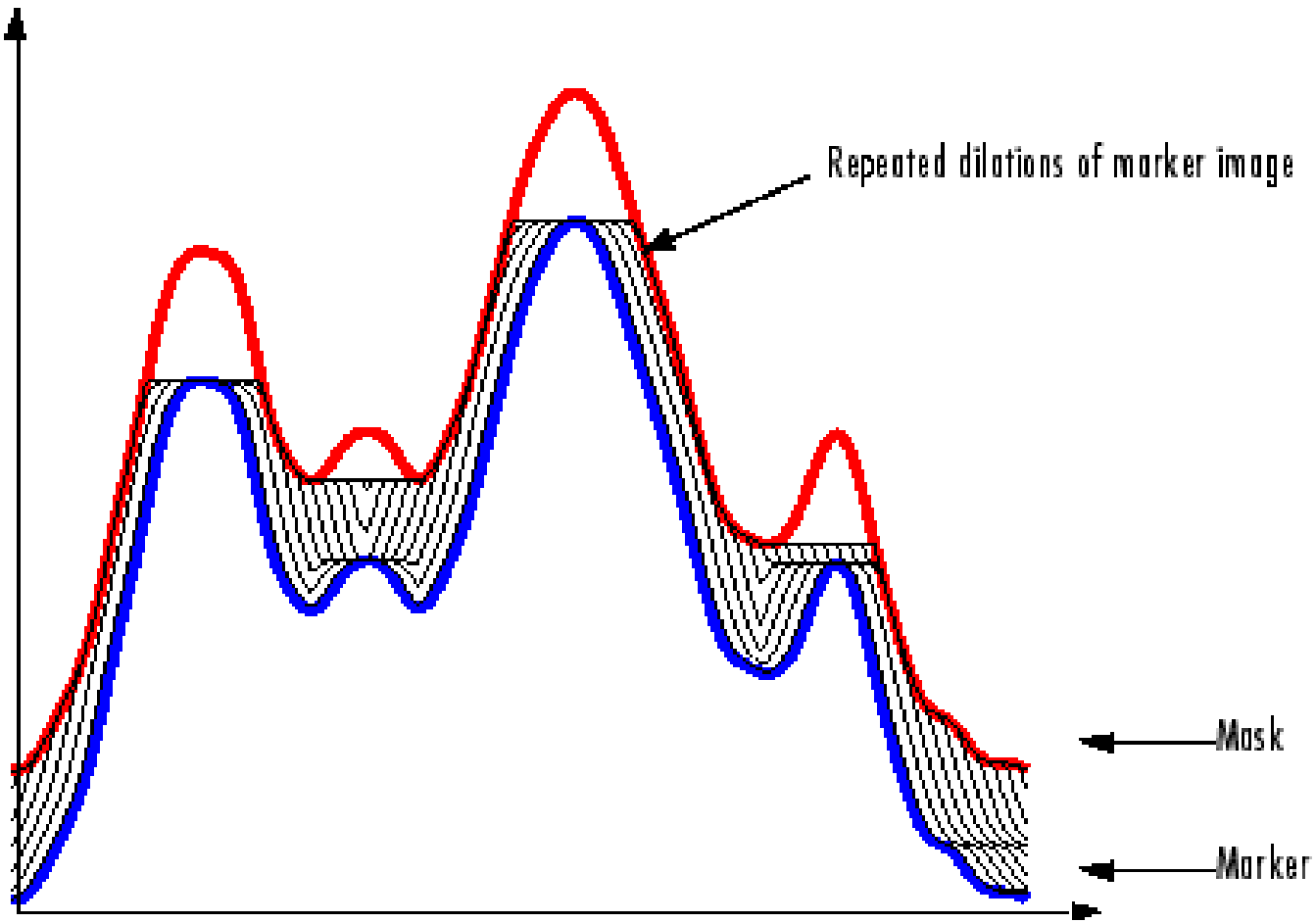
Morphological reconstruction

Main idea

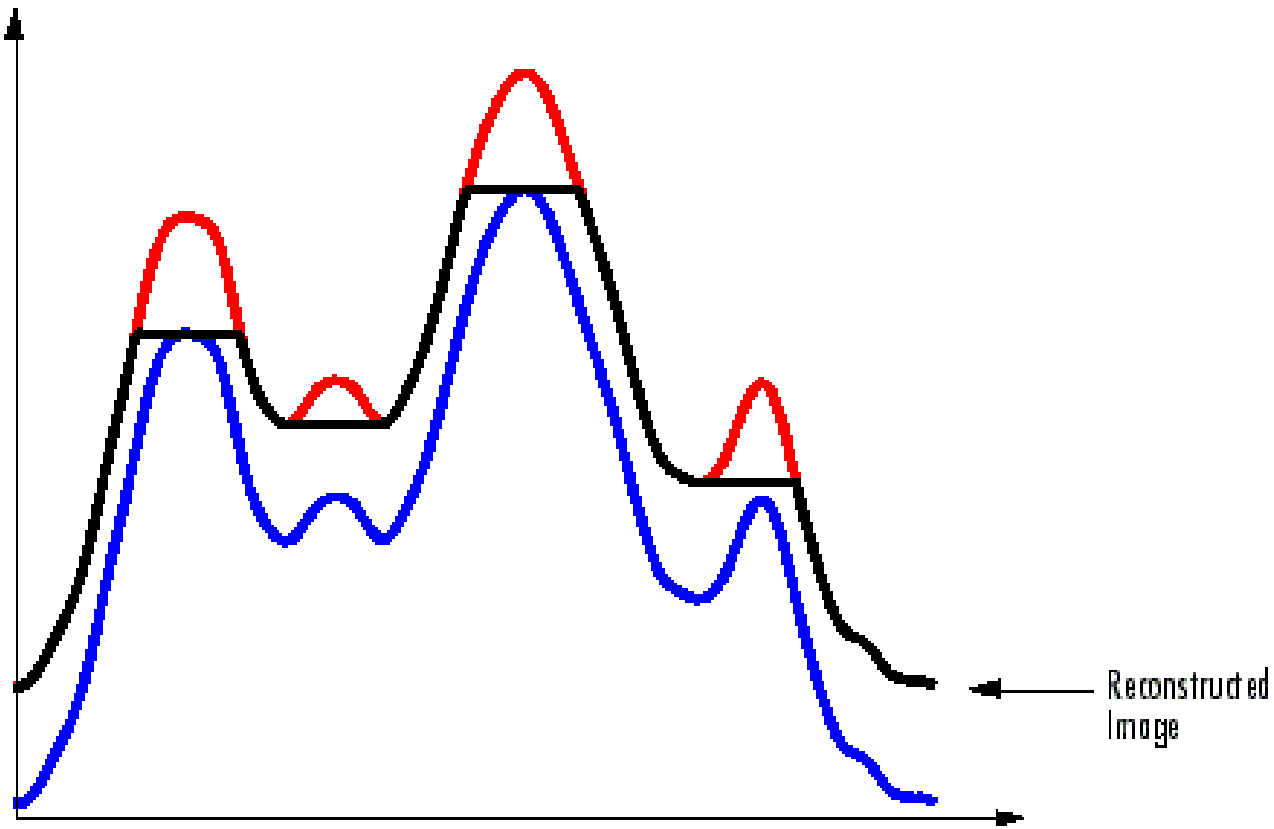
We use reconstruction to selectively segment particular objects in binary image *mask*. We make use of an auxiliary binary image *marker*, where we mark the locations of objects we want to segment in the original image. The reconstruction consists of repeated dilation of the *marker* image.



Morphological reconstruction



Morphological reconstruction



Morphological reconstruction

Filling a chosen object

We can use reconstruction to segment chosen objects in a binary image. To do this we choose a marker in a way which contains only the points that are in the object we want to segment.

imreconstruct

imreconstruct(marker, mask) - returns reconstruction of mask by the given marker.

Exercise

Use ginput and segment only the letter in text.png which gets clicked on by the user.